Landowners' Riches: The Distribution of Agricultural Subsidies*

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Abstract

The U.S. has a long history of providing generous support for the agricultural sector. The 2002 Farm Bill provides in excess of $190 billion in financial support to U.S. agriculture, an increase of $72 billion over previous programs. Our paper is concerned with the distribution of these benefits and their captures by landowners. We use a sample of individual farm data to investigate the contribution of each of the main types of farm programs to land values. We find that subsidies have a significant impact on farm land values especially price support programs with a built-in insurance feature. We also report evidence that cash lease rates incorporate a significant portion of agricultural support, even if the farm legislation mandates that benefits must be allocated to farm operators. Finally, taking advantage of the fact that some farmers rent land on both a cash and share basis, we find that farm programs that are meant to stabilize farm prices provide a valuable insurance benefit. The methodology we use throughout the paper attempts to account for this insurance feature of many agricultural programs. It leads us to formulate a number of caveats associated with existing studies of policy effects on farm land values.

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A recent news report asked the following question. What do basketball star Scottie Pippen, publisher Larry Flynt, and stockbroker Charles Schwab all have in common? The surprising answer is that they were all recipients of farm program subsidies.[1] Other recipients include former Worldcom chief Bernard Ebbers, part-owner of a farm that received nearly $4 million in subsidies between 1996 and 2000, the Chevron corporation, the Caterpillar corporation, and several other Fortune 500 companies.[2]

Support for U.S. farmers is often directed to individuals and corporations that seem to be some distance from the struggling family farm operator politicians love to remind us about. This fact has been the source of considerable debate in recent years, in particular since Congressional support for U.S. agriculture continues to expand.[3] However, the distribution of farm benefits does not stop where the checks from the Treasury are mailed. To the extent that eligibility for government benefits is tied to the ownership or operation of scarce assets, the market values and rents of these assets will reflect the portfolio of streams of cash flows to which they give a right. Such is the case with farm land, which gives rights to both returns from agricultural markets and payments from the government.

The issue has recently taken on new importance with the Bush administration's 2006 budget proposal that calls for a 9.6% cut in subsidies and a decrease in the total payments that a single farmer is allowed to receive each year from $360 thousand to $250 thousand. The proposed changes have already provoked promises of a fight over any cuts in support by farm lobbyists and representatives. The likelihood of such cuts being successful in the face of such strong bipartisan opposition is unclear. The debate does, however, highlight the importance of understanding how specific policy benefits are distributed among landowners and tenants and the extent to which farm land values are affected by policy benefits.

USDA statistics indicate that about 45% of U.S. farm land is operated by someone other than the owner. Contrary to conventional wisdom, most agricultural landlords (57%) are non-farm corporations or individuals that work in or are retired from non-farm-related activities. A significant proportion of landlords (15%) live more than 150 miles from the land they rent. Almost half (42%) the landlords live in a city, town or urban area.[4]

[1] "Farm Subsidies Help Those Who Help Themselves," a Fox News report by W. LaJeunesse, 7/15/2002.

[2] Data from the Environmental Working Group's farm subsidy database (`www.ewg.org`).

[3] President Bush signed an omnibus package of farm program support on May 13, 2002. Over the next ten years, the new Farm Bill will transfer about $190 billion from U.S. taxpayers to the farm sector. On a per year basis, this is about the same magnitude as expenditures on general science, space and technology (source: Budget of the United States Government, http://w3.access.gpo.gov/usbudget/.)

[4] Source: USDA Agricultural Economics and Land Ownership Survey (1999), and Mishra et al. (2002).

In light of these facts, a fundamental question arises regarding the distribution of farm support programs: to what extent do agricultural subsidies translate into higher land values and into higher land rents? This is a critical issue, not only for policymakers but also for farm operators who should understand the (limited) extent of their gain from the various programs they tend to support.

The capture of agricultural benefits by farm land is particularly problematic if the farm policies aim to support farmers and the farmers do not own their land when the policies are announced. The issue is obvious for the farmers who lease their land. Even when the law indicates that payments should go to the farm operator, the land lease rates are determined by the market. Furthermore, to the extent that (young) expanding farmers are paying for the expected policy benefits in the farm assets they acquire, the present value of future benefits is captured by the (old) sellers. New owners only benefit from surprise increases in public transfers.

A number of papers have attempted to estimate the capitalization of aggregate agricultural transfers into farm land values.[5] These papers suffer from a number of shortcomings which we are able to address here through the empirical analysis of a unique set of farm-level data. First, we are able to investigate the differential impact of the main farm programs because we observe the breakdown of government payments at both the farm and the county level. Second, we control for non-agricultural pressures on the land and determine how they affect its value. Third, we observe not only land values but also the terms of lease arrangements when relevant. This gives us the unique opportunity to assess directly the extent to which owners and farmer operators share the benefits of various agricultural programs, a useful complement to the indirect assessment we obtain from investigating land values. Finally, variations in the difference between cash lease rates and share lease rates enable us to investigate the extent to which the market values the insurance features built into some farm programs, features ignored by the literature.

Three recent papers have looked at the incidence of government programs on cash lease rates. Roberts, Kirwan and Hopkins (2003) and Kirwan (2004) estimate government payments and cash rents from the Agricultural Census in 1992 and 1997. They take advantage of the panel nature of the data to control for unobserved farm fixed effects in their estimation of the incidence of total government payments on cash rents. Unfortunately, the Census data on rental rates is limited to total cash rent payments and total acres rented. This is a problem given the significant proportion of farmers who use both share and cash lease

[5]See, for example, Goodwin and Ortalo-Magné (1992), Barnard et al. (1997), Ryan et al. (2001), Shertz and Johnston (1997), Shoemaker et al. (1990), and Weersink et al. (1999).

arrangements. Also, when land is rented under a share lease, the landlord receives his share of government payments directly from the government. Neither paper appears to take this feature into consideration. Lence and Mishra (2003) use county level cash rental rates and disaggregated government payments for the state of Iowa. Their estimates of the incidence of ad hoc assistance programs and decoupled payments are similar to ours. Contrary to our findings (and to the authors expectations), they find that price support payments have a negative impact on rents.

We build our farm level data set primarily from an annual USDA survey of farms over the 1998-2001 period. This period was characterized by a variety of different farm programs, including some which were not connected in any way to market conditions or production, at least in their design. At the other extreme are output price-support payments which were intimately tied to contemporaneous market conditions. We find that price-support payments have the strongest effects on land values. Payments that may signal future benefits, even in cases where they are not a permanent part of farm legislation, have lesser effects.

U.S. farm legislation typically intends benefits to be "shared" between the owner and operator of a farm in the same proportion as they share the risk of farming. Under cash lease arrangements, the tenant commits to a fixed payment to the landlord, independent of market returns and crop performance. In this case, the entire subsidy is sent to the tenant. Under share lease arrangements, the landlord shares in the risk of market returns and thus receives a share of the subsidy equal to the share of the land's output directly from the government.

Our empirical analysis indicates that owners extract a large proportion of farm policy benefits from tenants through cash lease rates. On the other hand, the results on share lease rates indicate that owners to not capture any of the portion of price support and decoupled payments that go to the farmer. Programs with strong insurance objectives (output-price support payments) significantly affect the gap between cash and share lease rates. In particular, the share rate premium is significantly diminished by programs that serve to lower the risk associated with uncertain farm earnings. This finding provides direct evidence of the land market pricing the insurance component of agricultural policy.

Accounting for this insurance benefit of agricultural policy raises two issues with the traditional approach to the assessment of the contribution of agricultural policy to farm land values. First, the insurance feature of several governmental programs raises questions about the traditional implicit assumption that a dollar of transfer today conveys the same information about future transfers, regardless of underlying market conditions and local

agricultural output. Instead, a low price-support payment this year may be due to high output prices and thus may not indicate a decrease in the expected stream of long run benefits from the price support program. This leads us to propose an empirical strategy different from the usual regression of land values on current government payments.

Second, those government transfers whose level are negatively correlated with earnings from agricultural markets decrease the volatility of land returns. To consider how this issue affects the interpretation of our empirical results, we find it useful to think about farm land as a portfolio of securities giving rights to a variety of cash flows (e.g., returns from wheat, from corn, from each type of government transfer). Within this context, it should be obvious that eliminating a security (e.g., output price support) whose payoff is determined in part by the performance of other securities in the same portfolio (e.g., returns from wheat) will affect the volatility of the overall portfolio. As a consequence, eliminating one or more type of farm subsidy would increase the required rate of return on all remaining expected cash flows from farm land. Regression estimates of the contribution of market earnings to the value of land depend on the policy environment. It is wrong to assume that such estimates would not change to reflect expectations of a more volatile stream of earnings from the land if price support programs were to be dismantled. This argument is different and complementary to the accepted idea that removing U.S. farm policy would affect world market prices.

The remainder of the paper is organized as follows. Section 1 gives a brief overview of the history and nature of U.S. farm programs. Section 2 discusses issues pertaining to model specification, estimation, and measurement of the relevant variables. Section 3 presents the data. The results of our empirical analysis are in Section 4. The final section offers some concluding remarks.

1 A Brief Overview of U.S. Farm Policy

Most U.S. farm programs have their origins in the New Deal legislation of the Great Depression. A variety of price and income support programs have been used over time to increase and stabilize farm earnings. These programs are revised approximately every 6 years by an omnibus "Farm Bill" package of legislation. In addition to this regular package of farm programs, support is provided through a number of other legislative channels. This is the case with farm programs such as crop insurance and conservation measures. On a regular basis, agriculture also benefits from ad hoc support (through emergency bills) that is not a part of any budgeted legislation.

Over most of its history, U.S. agricultural policy has used price supports, sometimes coupled with production controls, with the declared objective to provide income support to the farm sector, in particular the ever-struggling "family farm." Some support was made on the basis of a need for "parity" with the high relative agricultural prices of 1910.[6] In more recent times, price support was provided only to program crops (corn, wheat, cotton, rice, grain sorghum, rye, barley, and oats). Deficiency payments, determined by the difference between market and target prices, were paid to producers on the basis of their "base acreage." This base acreage reflected historical production (in most cases, acreage during the 1980s). The fact that price supports were tied to historical production patterns implied a lack of planting flexibility for producers. In addition, soybeans, now a major U.S. crop, was largely omitted in provisions for support due to the fact that it was not an important crop when most farm programs began.

In 1996, Congress agreed to what was intended to be a major overhaul of U.S. farm policy—the Farm and Agricultural Improvement and Reform (FAIR) Act. This Act is also known as the "Agricultural Market Transition Act" or AMTA. The nomenclature "Reform" and "Market Transition" was meant to indicate a major shift in policy away from government involvement and toward market oriented policies. Eligibility for price support was no longer based upon historical production—producers were free to plant whatever crops they desired. Soybeans were made eligible for price supports, which are now provided through the "Loan Deficiency Payment" (LDP) program. LDP payments are made on the basis of the difference between market and support prices (called the loan rates). The rhetoric accompanying the Act implied, in principle at least, that the legislation signaled a transition to an environment with limited government support. To compensate producers over this transition, a program of direct payments to those producers with base acreage (historical rights to program benefits) was instituted. These payments were known as AMTA or Production Flexibility Contract (PFC) payments. By design, AMTA payments were completely decoupled from the market—the only requirement for receiving AMTA payments was that the producer (or landowner) had established base acreage. Eligibility for such payments in no way depended upon current production patterns. In some cases, payments were made on land no longer in production. The AMTA payments were set to decline each year until the FAIR Act expired in 2002.

Ad hoc assistance has been a fixture in U.S. agricultural policy for many years. Periods of drought or poor market conditions frequently trigger ad hoc disaster payments. Under provisions of other farm legislation (the Crop Insurance Reform Act of 1994), Congress

[6]Though any link with market and production conditions in 1910 would seem difficult to make, arguments in favor of such "parity" pricing are still heard on occasion in farm policy debates.

stated an intention to make subsidized insurance the only mechanism for providing disaster relief. However, localized droughts and low market prices led Congress to rapidly retreat from this position and conclude that the support provided to farmers under the FAIR Act was not sufficient. Ad hoc assistance, in the form of yield compensations and payments for low market prices, termed "market loss assistance" (MLA), were then instituted. Market loss assistance payments totaled over $19 billion between 1998 and 2001. These payments were made on the basis of eligibility for AMTA payment benefits. Once again, since AMTA payments are based on historical production, there was no explicit eligibility requirement that recipients be actively involved in agricultural production.

A number of other programs have been important to agricultural policy. For example, a considerable amount of farm land (approximately 30 million acres) has been removed from production through the Conservation Reserve Program (CRP). The CRP pays producers annual rents to place their land in reserve under a ten- to fifteen-year lease agreement. Some of this land has base acreage associated with it, thus leading to AMTA and MLA payments on land in conservation reserve. In order to be eligible for the CRP program, land must be "erodible" and environmentally fragile. Such land is typically of a lower value in terms of crop production.

According to analysis by the Congressional Budget Office (CBO), the 2002 Farm Bill will increase federal spending on agriculture by $72 billion over the next ten years. Congressional debate over the 2002 farm legislation and the generous level of support that emerged from these deliberations has made clear Congress's intent to continue taxpayer support for agriculture. Over the last two years, farm subsidy outlays have increased by 40% while, at the same time, farm incomes have doubled (Egan, 2005).

2 Methodology

There are two ways to value farmland, the hedonic approach and the income approach. The underlying assumption behind the hedonic approach is that a plot of land is a bundle of attributes from which land derives its value. Hedonic estimation focus on the contribution of the various attributes to land value. For example, in their study of the impact of global warming on agriculture, Mendelsohn et al. (1994) use characteristics of the land such as local temperatures in various month, local rainfall in various month, soil erodibility and soil permeability.

Here, we are concerned with the contribution of various streams of cash flow to the valuation of land. We therefore adopt an income approach to valuation. This requires that we measure the expected cash flow from each stream of earnings land gives rights to as a first step to estimating the contribution of each one to the overall value of land.

2.1 The Income Approach to Farm Land Valuation

All government transfers help the farmers in at least one of two ways: by raising the returns to farming and by decreasing the volatility of these returns. The LDP and all disaster payment programs including MLA programs have major insurance components. Because the USDA aggregates disaster payments and MLA payments under a single category in the survey data we use, we denote this class of support payments as ad hoc assistance (AHA) payments. The AMTA payments are lump sum transfers determined by farmers' past activities. They are uncorrelated with present or future earnings from the market. The same is true with CRP payments. In addition to these transfers, land may also give the farmer the opportunity to generate non-agricultural earnings. The jackpot is to own land in an area under strong urban pressure with friendly zoning authorities, hence providing the opportunity to realize substantial capital gains by converting the land to residential or commercial use.

The value of a parcel of land is the present discounted value of expected cash flows from agricultural activities plus the value of the option to convert the land to non-agricultural use:

$$V_0 = \mathrm{E}_0 \left[\sum_{t=1}^{\infty} \frac{\mathrm{MKT}_t + (\mathrm{LDP}_t + \mathrm{AHA}_t + \mathrm{AMTA}_t + \mathrm{CRP}_t)}{(1+r)^t} \right] + \mathrm{CONV}_0, \tag{1}$$

where MKT denotes earnings from the market, CONV is the value of the conversion option, and r is the discount factor. The discount factor reflects the risk of the overall portfolio of individual streams of expected cash flows. This risk is not simply the sum of the individual risks because of the non-zero covariances, by design, between MKT payments, LDP and AHA support.

We estimate equations of the form

$$\begin{aligned} V_t &= \alpha_1 \, \mathrm{E}_t \mathrm{MKT}_{t+1} + \alpha_2 \, \mathrm{E}_t \left(\mathrm{LDP}_{t+1} + \mathrm{AHA}_{t+1} + \mathrm{AMTA}_{t+1} + \mathrm{CRP}_{t+1} \right) \\ &\quad + f(X; \beta) \end{aligned} \tag{2}$$

to estimate the combined effects of all government support, and,

$$\begin{aligned} V_t &= \alpha_1 \, \mathrm{E}_t \mathrm{MKT}_{t+1} + \alpha_2 \, \mathrm{E}_t \mathrm{LDP}_{t+1} + \alpha_3 \, \mathrm{E}_t \mathrm{AHA}_{t+1} \\ &\quad + \alpha_4 \, \mathrm{E}_t \mathrm{AMTA}_{t+1} + \alpha_5 \, \mathrm{E}_t \mathrm{CRP}_{t+1} + f(X;\beta) \end{aligned} \tag{3}$$

for the effects of different types of programs. The vector X represents variables aimed at capturing the value of the option to convert the land into non-agricultural uses and β is the vector of parameters of $f(.)$.

The earnings from AMTA and CRP are independent of current and future earnings from MKT, LDP and AHA, and from each other. The estimated coefficients on both variables in equation (3) depend on the risk of each stream of cash flow and its expected growth. Under the assumption that each stream of cash flow is expected to grow at a constant rate g, the estimated coefficient will be the inverse of the capitalization rate $\kappa = r - g$ where r is the discount factor.

Because the earnings from LDP and AHA depend on the earnings from MKT, the estimated coefficients of these three streams of cash flows in equation (3) will depend not only on their own expected growth and risk but also on how all three streams of cash flow contribute to the overall volatility of farm land earnings. The same will be true with the estimated coefficient on total government payments in equation (2).[7]

To study cash lease rates, share lease rates and the determinants of the difference between the two on farms which have both types of lease arrangements, we use equations of the same form as (3). Estimates from these equations will indicate to what extent various expected cash flows are shared between the farmer and the landlord. Obviously, we should not expect cash flow that do not affect cash lease rate to affect land values to the extent that land values are the present discounted value of expected future rents plus the option to convert the land to non-agricultural use.

2.2 Measuring Expected Cash Flows

To estimate the contribution of each source of earnings to farm land values and lease rates, we need estimates of expected next period cash flows for each source of agricultural earnings. This raises the following measurement issue. Let us suppose that agents correctly assess the

[7]Some have argued that AMTA payments affect farmers production decision because they affect their aversion to risk. Makki et al (2004) provide a review of the evidence and conclude that if decoupled payments have any such effects, they are very small.

true determinants of land values but the econometrician, working with actual realizations of policy outcomes from year to year, is unable to observe these factors. Instead the econometrician relates the observable annual realizations of market and policy outcomes to land prices. In this case, the econometrician is confronted with the classical problem of errors in the explanatory variables. Errors-in-variables may result in biased estimates.[8] This problem is compounded by the fact that the government operates more than one payment program, hence suggesting that traditional empirical approaches in the literature suffer from multiple explanatory variables observed with error.

A complicating factor arises in that the errors applying to observed policy benefits may be correlated in a typical sample. This correlation may assume two different forms—correlation of the errors across different programs (for a given farm) and correlation of errors across different farms in a sample. Both circumstances are likely to exist when one considers a pooled cross-section of farms, as is the case in our empirical analysis. Consider a case of two programs—price supports and market loss assistance payments. The extent of the support provided by the government is likely to vary considerably from year to year according to market conditions. Low price years realize larger payments for both programs. Thus, the errors associated with using realized benefits are likely to be positively correlated across the programs. The correlation could also be negative. Consider the case of price supports and yield disaster relief (a type of ad hoc assistance payment). In low yield years, market prices are likely to be high and thus price support payments will be low, though yield disaster benefits will be higher to compensate for the production shortfalls.

Another form of correlation is likely to be relevant when a pooled sample of individual farms is considered. Since realized program benefits are dependent upon aggregate market conditions, the errors are likely to be highly correlated across observational units (farms) in a given year. In a sample consisting of only a few years of data, the correlation across farms increases the estimation error and may further exaggerate the bias; year-to-year shocks may not average out when only a few years are observed. Furthermore, if realizations are highly correlated across units within a year, parameter estimates may shift considerably from year to year. If only a few years are observed, the estimates from a pooled sample may be sensitive to events in the years observed and thus may vary substantially across years and be more variable.[9]

[8]This problem is analogous to the standard omitted variable problem, where the omitted factor is the difference between what is observed and the true, latent value.

[9]See Goodwin et al. (2003) for a quantitative assessment of this issue in the farm land valuation context.

The standard approach to addressing this problem is to obtain instruments or proxy variables for those latent variables that are measured with error. An instrument should be correlated with the variable of interest but uncorrelated with the error pertaining to the observation. Proxy variables should minimize observational errors. We represent the expected payment benefits by constructing average values of each relevant policy variable over recent years. A standard instrumental variables estimation approach is also feasible, though the fact that payment realizations in any given year may be very weakly tied to long run expected benefits makes the utility of such an approach limited. This problem is exacerbated in a short sample when realizations are highly correlated in the cross section, as is true in our application.[10]

Our use of averages of past values raises one complicating factor. Our data set is not a true panel in that a different set of farms is sampled each year—meaning that repeated observations for an individual farm are not available. To represent expected earnings, we therefore utilize averages of past values of real earnings per acre *in the county* where the individual farm is located. We argue that earnings on an individual farm, in contrast, may reflect individual choices and characteristics of the farm operation. Transfer of the land to a new operator may result in different earnings realizations which are better represented using county-level averages. Furthermore observations for an individual farmer in a particular year might reflect crop rotation patterns whereas county-level acreage are more likely to reflect the average crop mix.

The errors-in-variables problem does not apply to all sources of government subsidies. Subsidies provided through AMTA payments and rents earned on land enrolled in the CRP program are known with certainty a priori. It is only those payments that are triggered by market and production conditions (price supports and ad hoc assistance payments) that must be proxied.

3 Data

The primary source of our farm-level data is a data set collected from a sample of farms through the USDA's National Agricultural Statistics Service (NASS) Agricultural Resource Management Survey (ARMS) project. We focus on the years 1998-2001 when the ARMS

[10]The nature of our data also complicates standard instrumental variables estimation techniques in that we cannot observe cross-sectional units in more than one year. This limits the availability of suitable instruments.

data contains detailed government payment information for various farm program benefits as well as extensive farm and operator characteristics for the years 1998-2001. All monetary values in our sample were adjusted to 2001 equivalent real values by deflating by the producer price index.

Besides detailed farm earnings, the survey also reports farm land values. Farm operators are asked to estimate the market value on December 31 of each year of their land, dwellings, and other farm buildings and structures. We restrict our attention to the value of land only, excluding trees and orchards.

To focus on policies directed at crop farms, the main recipients of farm subsidies, we excluded any farm from our analysis for which livestock product sales accounted for over 50% of overall farm sales or farms in counties where less than 10% of the county's farm acreage was in the main program crops (wheat, corn, cotton, soybeans, rice, oats, and grain sorghum).[11] Farms for which more than 50% of total sales were accounted for by nursery products, fruits, or vegetables were also dropped from our sample. Finally, we also excluded farms for which incomplete data were available. This left us with a small number of extreme outlier observations: 0.8% of our sample with land values exceeding $10,000 per acre. Such extreme observations represent non-typical agricultural properties and were therefore excluded from the sample.

To carry out our analysis of the determinants of farm land values, we need to observe all the payments to which the land gives right. An issue arises when a farmer uses land under a share lease agreement. In such a case, the government distributes payments to both tenant and landlord according to the proportion of the sharing arrangement. The survey does not report the government payments sent directly to the landlord. We therefore exclude all farms with one or more share lease contracts when we carry out the land value and cash lease regressions.[12] This leaves us with a sample of 5,929 observations for the analysis of land values.

A total of 4,202 farms report cash lease contracts and no share lease contract; 5,143 farms report share lease contracts. We use each of these samples to study the determinants of cash and share lease rates. A total of 3,312 farms report both share and cash lease contracts; this sample of farms enables us to study the factors affecting the difference between share and cash lease rates.

[11] This excludes farms in counties for which more than 90% of farm land is in pasture, rangeland, or fruits and vegetables production.

[12] USDA statistics indicate that, in 1997, two thirds of all rental arrangements were done on a cash only basis.

Cash rents are set at the start of the season. The farmer commits to pay the landlord a given cash amount, independent of returns from the land. A large proportion of leases are oral agreement running from year to year with regular rent adjustment. Written lease rate adjustment appear to follow a similar ad hoc process with small regular increases from year to year except following big changes in production pattern, technology or returns, with possibly some lag due to the time it takes for both parties to become aware of any changes and their economic consequences. Under a cash lease, the landlord does not share any of the production risk and therefore does not receive any direct payments from the government.

For share leases, specific sharing arrangements are set ex ante. The exact payment to the landlord is set ex post once all uncertainty about earnings has been resolved. Farmers report the total payments to the landlord.

We use independent data to compute a measure of expected earnings from the market for each farm. We acknowledge at the outset that any representation of market earnings should not be interpreted as a measure of the market returns that would be generated in the absence of farm policy. Returns in such a situation are difficult to assess, especially in light of the long history of government involvement in agriculture. Likewise, the relevance of such a consideration is limited—it is unlikely that the U.S. government will completely remove policies that currently support agriculture.

We start from county-level observations on yield, and state level prices (taken from NASS statistics). Multiplying yields and prices gives us expected gross revenue for each crop. Costs are much more difficult to measure due to data limitations. For wheat, barley, and cotton, we use national, annual average per-acre costs drawn from the ARMS survey. For corn and soybeans, we use cost budgets collected from the Iowa State University Extension Service. For grain sorghum (a minor crop), we use cost figures collected from budgets generated by the University of Arkansas Extension Service. These crops account for the overwhelming majority of U.S. crop-farm earnings; other minor crops were not included in the cost and returns measures. In every case, costs figures exclude the charge for land.

The difference between county-level revenues and costs for each crop provides our measure of county-level market earnings for each crop. We use weights constructed from the allocation of land within a county across the different crops (taken from NASS statistics) to compute the expected market earnings per acre of land. More precisely, the weight for each crop within each county is computed as the ratio between the acreage allocated to that crop in the county divided by the total acreage allocated to all crops under consideration in the county. It should be noted that, at least for our period of study, crop earnings do vary across counties

(according to crop mix) but are less volatile over time. For each farm level observation, we compute the average of this county-level expected earnings over the preceding four years as our measure of expected earnings.

Our measures of expected market earnings suffer from the lack of detailed information of county level production costs. It therefore possible that within the framework of our income approach to the valuation of farm land, we are not capturing some of the relevant differences in county level earning potential of the land. To get a sense of whether or not this is an issue, we rerun our preferred regressions adding a number of county-level variables that capture differences in the production potential of the land. These measure should be highly correlated with costs of production differences across counties. We rely on the land capability classes reported by the USDA Natural Resources Conservation Service. Classes 1 and 2 account for a bit more than half the crop land (classes 1 through 4). We build a land quality index that takes for value the proportion of land in the county that is in class 1 or 2 relative to the amount of land in classes 1 through 4. We also take advantage of the subclasses that indicate whether the soil has limitations within the rooting zone that are difficult to correct (LCCS), and whether the local climate is the major hazard of limitation affecting crop cultivation (LCCC). For each characteristic, we measure the proportion of land in the county that is subject to the corresponding problem.

We use historical averages to represent expected earnings from aggregate government transfers, as well as LDP and ad hoc assistance payments. We use a four- or five-year average of county-level total payments in our aggregate policy models, and for ad hoc assistance payments. In contrast, because the LDP program was not the main instrument for providing price support prior to the 1996 Farm Bill, we use a two- or three-year average for LDP payments at the county level.[13] Our land value analysis includes the current year's market and program receipts along with the preceding four years (two for LDP) while our analysis of rental rates excludes the current year since receipts were not known at the time lease contracts were determined.

Future CRP and AMTA type payments are known with certainty in advance by all parties up to the point where the political process is expected to review the relevant funding laws. We therefore use realized payments from these programs as proxies for expected future payments.

To the variables aimed at capturing expected cash flows from farming, we add factors intended to represent the additional value of land from the option to convert it to residential

[13]Prior to 1996, a different form of deficiency payments was used to support agricultural prices.

or commercial use in areas facing non-agricultural pressures. First, we consider population growth rates and the population density (people per square mile) in each county in the preceding year (U.S. Census Bureau). We also include a series of discrete indicator variables obtained from the USDA that represent the extent of urbanization for each county. The ordinal ranking ranges from 1=rural to 5=urban. In that very few farms were located in the most urban counties (less than 0.3%), we combined urban categories 4 and 5 into a single category. Finally, to try and represent residential housing pressures beyond what is already captured by the population variables, we include the total value of new housing permits issued in the county in which the farm is located. The permit data were collected from the U.S. Census Bureau. The permits apply to all forms of residential housing, both single-family and multi-family dwellings, and describe the total value of construction.

Summary statistics and definitions for the key variables of our analysis are presented in Table 1. A detailed list of farm programs is provided in an appendix along with indications as to how we regrouped the programs under the broad headings of our analysis.

4 Empirical Results

Our empirical analysis is focused on 5,929 farm-level observations on land values and rents. A number of our observations pertain to values for the county in which the farm is located: expected cash flows and urban pressure factors. This raises concerns regarding for correlation among errors for individual farms located within the same county.

We therefore use a blocked-bootstrap estimator. We assume that the unexplained residual parts of our models are uncorrelated across counties though potentially correlated within counties. We allow for such correlation by blocking our observations at the county level and randomly sampling from among our independent units—counties. The results which follow were calculated from 2,500 replications of the county-level blocked bootstrap.[14]

4.1 Land Prices—Aggregate Government Support

We first consider two models that aggregate all program payments into a single category. Such models provide a summary of the impacts of additional federal subsidy dollars on land values at the margin. Model I uses actual, observed payments for each farm. Model II uses

[14]For additional details on blocking designs in bootstrapped estimators, see Lepage and Billiard (1992), Efron and Tibshirani (1993), and, in particular, Hall, Horowitz, and Jing (1995).

our county-level measures of expected per-acre receipts from the market and from aggregate farm program payments. Recall again that both expected earnings are represented using the average in the county over current and the preceding four-year period. The results are presented in Table 2.

Model I indicates that $1 per acre of farm payments tends to add $6.38 per-acre to the value of farm land. We obtain a similar though somewhat larger estimate for the contribution of $1 of market earnings. An additional dollar of market earnings raises land values by $7.15. At the aggregate level, it appears that an additional dollar of support from the government has a similar effect on land values as an additional dollar of market earnings.

Model II replaces realized cash flows from the government and from the market with our preferred five-year average measures noted above. The results of this specification suggest different effects of earnings on land values. We now find that an additional $1 of government payment raises land values by $13.4 per acre, a much larger estimate than the earlier $6.35 effect. The estimate for the contribution of market earnings is basically identical to the earlier one, $7.16 instead of $7.15. Hence, under our preferred specification, dollars from the government seem to have a much stronger effect on land values, at the margin, than dollars from the market. The use of expected earnings instead of realized contemporaneous earnings does make a difference.

Models I and II also confirm the importance of the factors aimed at capturing the option to convert land to non farm uses.[15] A higher population growth rate is associated with higher land values. The USDA indicators aimed at capturing general urban pressures are all positive and significant. The most rural counties were chosen as our default category. When compared to these rural counties, counties with urban indicators of 2, 3, and 4-5, had land values that were approximately $283, $441, and $369 greater per acre, respectively. The option value to convert in the most urban counties might be lower because agricultural land in such counties may be protected by zoning restrictions.

Model III presents results of the same regression as Model II but with three extra variables aimed at capturing differences in production potential that may be missed by our lack of local cost of production data. The results are similar to those obtained in model II with an incidence of market earnings of $6.09 and of total government payments of $10.95. Two of the three land quality controls have significant effects. Greater overall land quality is

[15]Hardie et al. (2001) estimate the effects of urban pressure on agricultural land. They are not concerned, however, with the contribution of agricultural policy to the returns from land.

associated with greater land values. Land with significant climate limitations is found to be worth significantly less.

Model III mixes income and hedonic approaches and should be considered as a robustness test only. We already mentioned above how including land characteristics together with sources of income make interpreting all estimates problematic.

4.2 Land Prices—Specific Government Support

Next, we break out overall government payments into major types of programs. Models III and IV use actual payments and our measure of expected payments, respectively. Estimation results are reported in Table 3.

The estimates of the contribution of market earnings are similar to those obtained in Models I and II, around $7 per dollar of market earnings.

Once again, coefficient estimates differ depending on whether we measure government earnings with realized contemporaneous payments or expected earnings. The biggest difference between the alternative models concerns the LDP program. An additional dollar of expected LDP appears to add $27.37 to the value of land at the margin, against an estimate not significantly different from zero for realized LDP payments. Recall that this program helps farmers not only by increasing mean expected earnings but also by decreasing significantly the volatility of their earnings. The insurance nature of this program makes realized earnings particularly poor indicators of expected earnings.

In the case of ad hoc assistance payments, the coefficient obtained under our preferred specification is not significantly different from zero. The major difference between LDP and ad hoc assistance programs during the period of our study is the year-to-year financing of the latter compared to the security granted to the LDP program which was part of the Farm Bill. The fact that ad hoc assistance payments do not significantly influence land values may reflect this year to year funding uncertainty.

In both models, AMTA payments are estimated to have a similar incidence on land values, between $4 and $5 at the margin. The degree to which AMTA payments influenced land values depended on land owners' expectations that such benefits would be extended beyond the expiration of the 1996 FAIR Act. The payments were intended to decline in magnitude each year and expire with the FAIR Act in 2001. In light of the fact that Congress generously extended AMTA payments, it will be interesting in future years to see

whether such supposedly decoupled instruments continue to have only a small effect on land values.

Empirical estimates suggest that farmers receiving CRP payments tend to work with less valuable land. The land that ends up covered by the program tends to be land with weak prospects of market returns and more prone to erosion. Likewise, land committed to CRP contracts is necessarily removed from production. If this land is transferred through sale to a new owner, the new owner assumes the responsibility for fulfilling the terms of the contract. If the new owner does not succeed to the CRP contract, the original owner must refund all rents and cost sharing expenditures. Such restrictions likely have a depressing effect on CRP land that is subject to transfer through sale.

The effects of urban pressures, population growth, housing pressures, and market returns are very similar to what was implied by the aggregated policy models. In every case, urban pressures play an important role in determining agricultural land values.

As earlier, to get a sense of the robustness of our findings, we re-estimate Model V adding our three county-level controls for production potential. The estimation reported as Model VI in Table 3 shows results that are again similar to the ones without the quality controls. Again, the incidence of market earnings is estimated to be slightly lower and still significantly smaller than the incidence of LDP. The estimate for the incidence of ad hoc assistance payments remains insignificant, the incidence of AMTA payments remains at around \$4 per \$1 received.

In all, the above results provide strong evidence that land captures policy benefits. In contrast to the existing literature, we have argued in favor of measures of expected payments instead of typical measure of current payments as determinant of land values. We find substantive differences in estimates depending on which of the two types of measure we use. This is particularly true for LDP and ad hoc assistance payments, the two programs with the most significant insurance component built in and hence the two programs for which current payments are a poor indicator of expected future government support.

4.3 Lease Rates

If land values depend on policy transfers it must be that land rents reflect policy transfers. We consider regressions of cash and share rents, respectively, against the factors expected to be relevant to land values and rents, including the indicators of expected payments. The results are presented in Table 4. We estimate the same models with the extra county-level

controls for production potential and obtain very similar results. They are reported in Appendix Table 2.

Higher levels of expected market earnings are correlated with higher rental rates (estimate of $0.35 per $1 of expected market earnings). Expected LDP benefits have a larger effect on rental rates than expected market earnings. An additional dollar of LDP payments raises the cash rental rate by $0.83. The large difference between the incidence of market earnings and LDP support on cash rent goes part of the way in explaining the large difference between the incidence of each stream of cash flow on land value.

Ad hoc assistance payments do not appear to have a significant effect on cash lease rates. This result is consistent with our earlier result on the absence of effect of ad hoc assistance payments on land values.

In the case of AMTA payments, an additional dollar per acre of payments raises cash rents by $0.29 per acre. Note that the AMTA variable measure the value of the payment that was known to landlords and tenants at the time lease contracts were determined. A significant proportion of AMTA payments goes to the landowners.

CRP payments are associated with substantially lower cash lease rates. Again, this result is not surprising given use restrictions and lower quality of such land. Land committed to CRP contracts is of very limited use to tenants over the term of the contract and the assumption of management responsibilities for absentee landowners may result in lower overall rental rates when a rented farm has some CRP land.

Indicators of urban pressures are generally not significant.

Table 4 also presents regression results for a model of share rents. Recall that those farms with share leases were omitted from the analysis of land values and cash rental rates since we only observe the share of payments going to the operator. Thus, our analysis of share leases pertains to a different sample of farms.

It is also important to recognize that our inferences in the model of share leases differ in that they pertain only to that portion of the payments that goes directly to the farm operator; we do not observe the portion that goes directly to the landowner. This may explain why LDP payments do not appear to exert a significant effect on share rental rates. It appears that landlords do not capture a significant portion of the share of LDP support that goes to the farmer. The same holds true for the portion of AMTA payments that goes to the farmer. The estimated coefficient for the incidence of AMTA payments is also not significantly different from zero.

Other effects are also likely relevant. A large literature addressing the choice of rental arrangements has concluded that share lease arrangements are often risk sharing mechanisms and thus include a risk premium that is not present in cash rents. It is thus possible that price support payments have several effects on lease arrangements that partially offset one another—increases due to the direct wealth effects and decreases due to a lower degree of market risk. This may explain the estimate of $4.66 obtained for ad hoc assistance payments. This very substantial effect likely reflects the fact that ad hoc assistance payments are, by definition, targeted toward risky areas and crops. Thus, the very large effect on share rental rates is likely associated with the fact that a much larger risk premium is associated with land that receives ad hoc assistance payments.

4.4 Insurance Benefits

It is difficult to directly compare the effects of various factors on cash and share lease rates since the lease rates are drawn from different farms and different landlords. However, such a comparison is possible for a sub-sample of farms that rented land both by cash and share rental arrangements. Though rental arrangements may differ across different tenants and landlords, this at least holds all tenant characteristics constant across the two different types of rental arrangements. The difference in lease rates for such farms is the focus of our analysis here. We are particularly interested in uncovering whether the programs designed to provide insurance to farmers have a significant effect on the relative pricing of share and cash leases.

The main program designed to reduce the variability of farm earnings and insure the cash flow to farmers is the LDP program. Ad hoc assistance payments are not budgeted and suffer from the uncertainties of the political process from year to year. If the insurance component matters, we should find that higher LDP payments should be correlated with a lower risk premium on rental arrangements. This risk premium is represented by the difference in cash and share lease rates on the subset of 3,296 farms that report renting land under both types of arrangements. By committing to an ex-ante fixed payment, the farmer provides insurance to his landlord for which we should expect him to be rewarded.

To evaluate this risk premium, we regressed the share-cash rental premium on policy benefits and other factors suspected to be relevant to rental rates. These results are also presented in Table 4. We find that LDP payments do indeed tend to significantly decrease the share-cash premium. An additional dollar in expected LDP payments lowers this premium by $3.20. In contrast, ad hoc assistance payments tend to substantially raise the premium, minus $7.49 per expected dollar of ad hoc assistance. This coefficient must reflect the fact

that ad hoc assistance payments naturally are targeted toward areas more likely to suffer a disaster (a crop failure)—in other words, riskier areas. With the exception of market earnings, which have a modest positive influence on the share-cash differential, the other factors do not appear to significantly affect the risk premium implied by the rental rate differences.[16]

4.5 Caveats–Methodology

Although the paper benefits from much more detailed data than previous attempts at quantifying the impact of agricultural policy on farm land values, that does not mean our estimates provide a better answer as to the total contribution of agricultural policy to farm land values. In spite of frequent attempts in the literature to do so, such measurements cannot be extrapolated from land value regression estimates such as ours for several reasons. First, regressions yield the effects of the marginal dollar for each type of policy. Second, without US agricultural policy, agricultural commodity prices and markets would be different. Both caveats are well known even if often ignored in the policy debate.[17]

The literature has however overlooked four more issues. First, thinking again about land as a portfolio of securities each delivering its stream of cash flow, it is obvious that the risk of the portfolio depends on the covariance of the various underlying securities. In terms of the analysis of the contribution of government programs to land values, this implies that eliminating a policy which provides an insurance benefit will not only decrease expected returns, it will also increase the volatility of the remaining (market) returns. In other words, we should expect the coefficient on market earnings to decrease in response to an increase in uncertainty.

Second, the analysis focused on assessing the proportions of various types of support programs reflected in land lease rates and prices. That does not imply that the remainder goes to the farm operator. As Floyd (1965) pointed out, there is no theoretical reason to assume that other participants in the agricultural and food industry do not capture at least some of the government payments that are not captured by the land.

[16] Allen and Lueck (2002) argue that transaction costs are the critical determinants of whether farmers rent land under a share or a cash lease. They present empirical evidence in favor of their argument and point to the scarcity of evidence that risk considerations make any difference. Our results provide one extra step toward remedying this scarcity.

[17] See, for example, the recent USDA report of Barnard et al. (2001).

Third, we should expect farmers to change their crop allocation in response to any deviation in the policy mix offered to them. For example, we know that soybean acreage increased dramatically when it was brought under the coverage of the LDP program in 1996. If crop allocations respond to farm support increases, they will also respond to farm support decreases. Within our portfolio view of farm land this tells us that we should expect farmers to vary the weights they give to each underlying security (wheat, corn, soybean, ...) in response to changes to any of the government financed streams of cash flow. This arguments provides another reason why coefficients from regressions such as ours should not serve as the basis for the computation of the total contribution of agricultural policy to farm land values.

Finally, it should be acknowledged that the U.S. government supports agriculture through a number of other programs that provide benefits indirectly rather than through direct payments. For example, farmers benefit from subsidized interest rates, subsidized crop insurance, federally-funded education and research programs, and a myriad of other programs. Such program benefits are also likely to affect asset values, though the link is less direct. Our analysis essentially holds such program benefits constant across different farm during our period of study.

5 Concluding Remarks

Summarize result and comfort for similar estimates of 7 for market across basically all regressions.

Put regressions with land quality controls in appendix because they are robustness not the ones we like.

We learn something from the empirical exercise, it must show in conclusion.

Policy rhetoric often justifies Farm Bill expenditures with the argument that impoverished farmers are in need of governmental support to remain in business. This view is pervasive within and outside of Washington. For example, consider the annual "Farm Aid" events intended to draw attention to the plight of the American farmer. Many have challenged this view putting forward evidence on the high proportion of farm policy funds going to wealthy farmers on the one hand and to non-farmers on the other.

Our analysis goes further. We demonstrate that substantial benefits from agricultural policy do not remain with the farm operator but are captured by landowners through higher

land values and higher lease rates. In addition, at a time when agricultural programs are coming under intense scrutiny, our estimates highlight how government dollars have significantly different impacts on land values depending on the design of the program whereby they are allocated. For example, we find that dollars channelled through the price insurance program (LDP) have a very strong effect on land values and most of the benefits are captured in cash rents. We find however no evidence that the proportion of these payments destined to the farmer is captured by landlord through share lease payments.

Of course, many farmers are also landowners and thus have an important stake in maintaining agricultural policy benefits. A farmer that purchased land which reflected the value of anticipated benefits would certainly suffer a capital loss if such support were to be withdrawn. Furthermore, all landowners have a strong interest in Congressional surprises whereby more transfers are allocated than anticipated by the land market. As owners they benefit from the unexpected capital gains. Our relatively small estimate for the capitalization of decoupled payments that were supposed to end in 2001 indicate that the 2002 Farm Bill with its large increase in federal support may have been one such surprise.

Tenants also gain from positive surprises as long as cash lease rates do not adjust instantaneously. However, the 2002 Farm Bill seems to have inhibited this avenue for a temporary increase in the share of transfers captured by farm operators. One important provision of the bill is that Landowners were given the option to update the determinants of the decoupled payments (base yields and acreage) on the basis of production on their land between 1998 and 2001. Not surprisingly, tenant farmers have complained that this updating provision provided landowners with the opportunity to renegotiate the terms of their leases in order to better capture the increased benefits provided by the legislation.

By allowing landowners to update the determinants of such support, Congress has established a precedent that signals that future "decoupled" support may be tied to current or future production—a fact that has not gone unnoticed by U.S. competitors in ongoing WTO discussions. In light of such policy developments, one is left to wonder whether Congress is ignorant about the workings of the farm land market and the distribution of farm policy benefits to non-farmers, or whether Congress is purposefully serving another constituency with these transfers.

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Table 1. Variable Definitions and Summary Statistics*

Variable	Definition	Mean	Std. Dev.
Value	$/acre reported value	1,598.8986	1,339.1501
Market Return	Market return using market prices	17.5771	65.9299
Market Average	Average market return over preceding 5 years	66.3611	75.6968
Total Payments	Total program payments	41.0809	38.3218
Mean Total Payments	Average total payments over preceding 5 years	27.7273	15.9101
LDP	Loan deficiency payment receipts ($/acre)	15.1720	21.8203
Disaster	Disaster payment receipts ($/acre)	6.8809	15.3756
CRP	CRP payment receipts ($/acre)	1.0391	4.1869
AMTA	AMTA payment receipts ($/acre)	14.6422	18.2512
Mean LDP	Average LDP payments over preceding 3 years	9.3460	9.6423
Mean Disaster	Average Disaster payments over preceding 5 years	6.7989	5.3251
Population	County average persons per square mile	91.6881	162.3183
Population Growth Rate	Population growth rate (proportion)	0.5777	2.4461
Urban $_2$	1 if Urban category 2, 0 otherwise	0.1120	0.3154
Urban $_3$	1 if Urban category 3, 0 otherwise	0.1164	0.3207
Urban $_{45}$	1 if Urban category 4 or 5, 0 otherwise	0.1503	0.3574
Housing Starts	Total value of housing permits ($ten-million)	5.4220	23.2900
Cash Rental Rate	Cash rental rate	71.3792	73.2749
Share Rental Rate	Share rental rate	100.8190	162.1605
Share-Cash Difference	Share-cash rental rate difference	40.6802	185.8773
Land Quality	Percent county land in classes 1-2 relative to 1-4	0.5491	0.2254
LCCS	Percent county land with rooting zone problems	0.1203	0.1279
LCCC	Percent county land with climate problems	0.0260	0.0732

*Summary statistics computed from the sample of farms used in the land value regressions except for the cash and share lease rates and share-cash rate differences, which were computed from the relevant sub-samples.

Table 2. Aggregated Policy Models of Land Value Determinants:
Parameter Estimates and Summary Statistics

Variable	Model I	Model II	Model III
Intercept	969.3658	508.9531	450.6520
	(42.9131)*	(38.3558)*	(59.3943)*
Market Return	7.1528		
	(0.4167)*		
Mean Market Return		7.1272	6.0859
		(0.3967)*	(0.4146)*
Total Payments	6.3843		
	(1.0070)*		
Mean Total Payments		13.4345	10.9541
		(1.3382)*	(1.3865)*
Population	0.7768	0.6588	0.5060
	(0.5321)	(0.4713)	(0.4432)
Population Growth	66.4856	61.4321	60.9055
	(10.3177)*	(9.6241)*	(9.6063)*
Urban_2	283.3874	224.4137	218.3484
	(73.3986)*	(75.3839)*	(74.1517)*
Urban_3	440.6304	477.3832	410.8193
	(85.7913)*	(81.7330)*	(80.6395)*
Urban_{45}	368.5318	407.1980	330.7919
	(97.8455)*	(91.6150)*	(89.7817)*
Housing Starts	8.9262	10.8238	13.4107
	(5.5958)	(5.5431)	(5.2262)*
Land Quality			525.4878
			(93.7130)*
LCCS			−371.6314
			(272.5642)
LCCC			−1589.4600
			(203.1236)*
Number of Observations	5,929	5,929	5,929
R^2	0.1786	0.1846	0.1913

*Indicates statistical significance at the $\alpha = .05$ or smaller level. R^2 given by squared correlation of actual and predicted values.

Table 3. Disaggregate Policy Models of Land Value Determinants:
Parameter Estimates and Summary Statistics

Variable	Model IV	Model V	Model VI
Intercept	1004.3800	607.9558	598.0227
	(42.0510)*	(39.1433)*	(61.9975)*
Market Return	7.1732		
	(0.4122)*		
Mean Market Return		7.0786	6.3639
		(0.4025)*	(0.4239)*
LDP	8.3206		
	(4.6736)		
Mean LDP		27.3707	22.4763
		(3.8035)*	(3.7356)*
AHA	6.5136		
	(2.7942)*		
Mean AHA		−2.1490	0.9902
		(8.3647)	(8.1735)
AMTA	4.9434	4.1582	3.6885
	(1.4815)*	(1.4362)*	(1.4502)*
CRP	−30.1293	−26.4545	−24.6247
	(5.2947)*	(5.1450)*	(4.8364)*
Population	0.7380	0.6041	0.4876
	(0.5220)	(0.4553)*	(0.4306)
Population Growth	65.7800	60.1999	58.3697
	(10.2241)*	(9.1062)*	(9.2009)*
Urban_2	273.7824	210.2894	212.1243
	(73.1423)*	(73.0713)*	(72.6638)*
Urban_3	433.3592	438.5912	402.3318
	(84.7290)*	(80.3610)*	(79.4340)*
Urban_{45}	356.2402	353.8779	317.2536
	(96.6202)*	(88.9142)*	(87.3813)*
Housing Starts	9.3272	11.5727	13.3279
	(5.5173)	(5.3730)*	(5.1657)*
Land Quality			301.8020
			(94.9391)*
LCCS			−328.2688
			(264.1936)
LCCC			−1372.5000
			(202.3158)*
Number of Observations	5,929	5,929	5,929
R^2	0.1859	0.1926	0.1984

*Indicates statistical significance at the $\alpha = .05$ or smaller level. R^2 given by squared correlation of actual and predicted values.

Table 4. Models of Land Lease Rate Determinants:
Parameter Estimates and Summary Statistics

Variable	Cash Rents	Share Rents	S–C Difference
Intercept	32.5788	36.1522	8.1588
	(2.3715)*	(4.2840)*	(6.6194)
Mean Market Return	0.3518	0.5107	0.1512
	(0.0202)*	(0.0406)*	(0.0611)*
Mean LDP	0.8334	−0.6006	−3.2020
	(0.1228)*	(0.6557)	(1.0346)*
Mean AHA	0.4546	4.6612	7.4937
	(0.2672)	(1.5676)*	(2.4998)*
AMTA	0.2893	0.0840	−0.2593
	(0.0891)*	(0.1788)	(0.2808)
CRP	−0.4121	−1.7280	−0.6608
	(0.2199)	(0.3551)*	(0.4856)
Population	−0.0058	0.1174	0.1243
	(0.0061)	(0.0796)	(0.0980)
Population Growth	0.6005	2.7183	3.5990
	(0.6256)	(0.9782)*	(1.5241)
Urban_2	−1.4861	22.4632	21.3727
	(2.4954)	(10.9891)*	(16.4211)
Urban_3	−2.4696	29.1857	36.5781
	(2.1600)	(12.6646)*	(17.0765)
Urban_{45}	9.6389	5.8632	−0.1339
	(4.8714)	(11.0910)	(14.2395)
Housing Starts	−0.1919	−1.0635	−1.2674
	(0.0502)*	(0.6236)	(0.8832)
Number of Observations	4,202	5,143	3,312
R^2	0.1588	0.0742	0.0288

*Indicate statistical significance at the $\alpha = .05$ or smaller level. R^2 given by squared correlation of actual and predicted values.

Appendix Table 1. Commodity Credit Corporation Payment Categories and Outlays (1994-2001)

Program	Per-Farm Average 1999 US$	No. Farms Receiving	Total Outlays 100,000s 1999 US$
..... Deficiency Payments			
Barley Assessment Deficiency	244.32	413	1.01
Cotton Deficiency	2,809.38	277,995	7,809.94
Feed Grain Deficiency	1,513.10	2,373,141	35,908.00
Market Gains Early	2,883.55	17,817	513.76
Rice Deficiency	14,011.45	93,647	13,121.30
Rice Marketing	97.86	3,862	3.78
Wheat Deficiency	1,083.59	1,206,539	13,073.94
Winter Wheat Deficiency	1,735.82	92	1.60
..... AMTA Payments			
Production Flexibility	3,927.56	7,977,960	313,339.17
..... Loan Deficiency Payments			
Acreage Grazing Payments	1,377.27	4,236	58.34
Crop Special Grade Rice Ldp	15,484.99	285	44.13
Ldp, Non-Contract Pfc Growers	1,371.94	58,524	802.91
Lip - Contract Growers	792.29	1,229	9.74
Loan Deficiency	5,742.58	3,249,871	186,626.44
Market Gains Late	7,483.91	354,644	26,541.24
..... Ad Hoc Assistance Payments			
Ailfp – Apportioned	5,361.16	1,050	56.29
American Indian-Livestock Feed	5,069.59	2,389	121.11
Amlap - Apportioned	11,609.85	7,647	887.81
Citrus Losses In California	2,041.30	987	20.15
Crop Disaster Program	5,195.28	548,307	28,486.08
Crop Loss Disaster Assistance	7,444.63	249,505	18,574.72
Dairy Disaster Assistance	6,512.61	1,161	75.61
Dairy Indemnity	5,955.03	215	12.80
Dairy Market Loss Assistance	4,928.94	187,709	9,252.06
Disaster	4,820.76	458,603	22,108.15
Disaster – Non-Program Crops	−626.76	1	−0.01
Disaster – Program Crops	−5.18	1	0.00
Disaster Reserve Assistance	1,688.82	83,367	1,407.92
Emergency Conservation	2,446.12	102,788	2,514.32
Emergency Feed	−3,802.68	545	−20.72
Flood Compensation Program	17,574.48	38	6.68
Karnal Bunt Fungus Payment	48,729.44	653	318.20
Lamb Meat Adjustment Assist	831.88	26,400	219.62
Livestock Emergency Assistance	1,741.29	631,191	10,990.87
Marketing Loss Assistance	3,297.56	5,364,709	176,904.50
Nap-Supplemental Appropriations	2,654.72	1,378	36.58
Noninsured Assistance Program	2,709.44	87,710	2,376.45
Nursery Losses - Florida	39,562.62	155	61.32
Oilseed Program	754.04	1,184,715	8,933.22
Pasture Flood Compensation	1,558.14	12,237	190.67
Pasture Recovery Program	1,418.56	34,612	490.99
Peanut Marketing Assistance	4,146.14	27,079	1,122.73
Peanut Marketing Asst Pgm Iii	2,920.30	17,264	504.16
Poult Enteritis Syndrome	12,159.09	136	16.54
Quality Losses Program	2,919.67	16,800	490.50
Supl Oilseed Payment Program	667.76	586,241	3,914.68
Supplemental Tobacco Loss	354.97	335,613	1,191.33
Tobacco Disaster Assistance	7,436.30	343	25.51
Tobacco Loss Assistance	938.26	343,992	3,227.54
WAMPLAP II - apportioned	831.69	20,920	173.99
WAMPLAP III - apportioned	744.50	20,581	153.23
Wool & Mohair Market Loss Asst	518.49	18,584	96.36

Appendix Table 1. (continued)

Program	Per-Farm Average 1999 US$	No. Farms Receiving	Total Outlays 100,000s 1999 US$
	Conservation		
Agricultural Conservation	1,697.63	286,787	4,868.58
Arkansas Beaver Lake	4,751.71	220	10.45
Crp Annual Rental	4,373.45	2,750,839	120,306.57
Crp Cost-Shares	2,153.74	248,309	5,347.93
Crp Incentives	1,729.85	62,130	1,074.76
Emergency Conservation	2,446.12	102,788	2,514.32
Rural Clean Water	5,443.42	90	4.90
Soil/Water Conservation Assist	3,984.59	199	7.93
Water Bank - Annual	1,469.54	7,097	104.29
Water Bank-Practice Cost/Share	1,536.03	7,225	110.98
Wetlands Reserve	7,097.91	258	18.31
	Miscellaneous		
Additional Interest	91.11	193	0.18
Arkansas Beaver Lake	4,751.71	220	10.45
Dairy Termination	−3,094.10	6	−0.19
Extended Farm Storage	1,152.30	19,632	226.22
Extended Warehouse Storage	1,199.69	3,964	47.56
Feed Grain Diversion	−1,150.18	17	−0.20
Finality Rule	817.14	724	5.92
Fresh Market Peaches Program	6,222.15	126	7.84
Interest On Ccc-6'S	8.39	1	0.00
Interest On Nap Payment	24.99	184	0.05
Interest Payments	26.70	723,122	193.07
Milk Diversion	−579.86	2	−0.01
Milk Marketing Fee	1,237.73	199,452	2,468.68
National Wool Act	2,351.07	154,311	3,627.96
Options Pilot Program	9,115.39	3,164	288.41
Payment Limitation Refund	−2,834.04	2,271	−64.36
Potato Diversion Program	16,619.29	918	152.57
Small Hog Operation Program	2,094.50	57,951	1,213.78
Sugar Pik Diversion Program	12,806.77	10,216	1,308.34
Wheat Diversion	−19.95	1	0.00